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FINAL REPORT

LARSON-HUBBS II
HILL COUNTY, MONTANA

JANUARY, 1986

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HILL COUNTY, MONTANA

JANUARY, 1986

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LARSON HUBBS II

SCOPE:

The objective of this project was to stabilize a portion of Montana 232 that was undermined by an abandoned coal mine.

The project site is located on the Hubbs Mine in the Southwest 1/4 of Section 24, Township 33 North, Range 15 East, and consisted of approximately 130 feet of centerline along Montana 232. The site is approximately located between stations 237+00 and 239+00 of Federal Aid Project 301. The undermining in this portion of the highway was identified in the exploration and project planning phase of the LARSON-HUBBS project. The final report for LARSON-HUBBS describes the history and project planning for the overall site as well as the surface reclamation work accomplished under separate contract. This report is limited to stabilization of the highway.

PROJECT PLANNING:

Project planning began in February, 1984 when the first exploratory drilling indicated that the highway may be undermined. Further exploratory drilling was conducted in June and August of 1984. This drilling is shown on Drawing No. 1 as existing boreholes. Drilling along both sides of the highway located approximately 130 feet of the highway that was at least partially undermined. Variable depths to shale, the presence of perched groundwater in a part of this area, and differing heights of collapsed material led to the conclusion that the mine was in an active collapse mode and the mine did pose a threat to the highway.

Several different reclamation techniques were considered. Site factors that limited the reclamation techniques included groundwater and the mine condition. The mined seam was at about a 70-foot depth and

groundwater was at about 35 feet so the mine was completely flooded. Dewatering the mine was not considered practical and may result in induced subsidence. In addition, the mine was partially collapsed. Roof collapse had progressed as much as 16 feet above the mined seam. The result was a flooded mine void partially filled with loose roof collapse. Normal pneumatic or hydraulic methods will not work well in these conditions. Pressure-pumped grout backfilling was selected.

The grouting technique was set up for medium pressure pumping. Grout pressures of up to 100 PSIG at the surface were allowed. This pressure is sufficient to consolidate and solidify the collapsed material. A hole spacing was selected that would insure complete coverage of the voids. Plans and Specifications were prepared and the Contract was put out for bids.

WORK DESCRIPTION:

Bids were opened for LARSON-HUBBS II on September 25, 1985. Shumaker Trucking and Excavating Contractors, Inc. of Great Falls was the low bidder. Construction began on October 21, 1985 and progressed smoothly through completion on November 7, 1985.

Drilling was done with an air-rotary water well rig using a 5-7/8-inch drag bit. Only two holes required casing in order to drill. Water was routinely injected into the drill fluid. Photo 15 shows drilling in BH-126 with water injection. This borehole is located in the highway ditch.

Following drilling, a three-inch diameter grout injection tube was inserted into the borehole. Water was circulated through the pipe during installation to facilitate placement through caved and collapsed material. Photos 16 and 17 show the tube being inserted into BH-126. The grout line was then connected to the injection tube.

Grout was pumped by a Thompson 875 concrete pump mounted on a Kenworth

truck. The pump truck (shown in Photo 4 and 5) had a 70-foot, three piece articulated boom that allowed reach over utilities and other equipment. A pressure gauge was installed at the top of the injecton tube just after the last reducer. Photo 20 shows a typical setup during pumping. Grout was pumped at a rate of 25 to 30 cubic yards per hour. Gauge pressure at the top of the injection pipe was typically in the range of 20 to 50 psig with highs up to 130 psig. Grout was supplied by Rudyard Ready Mix.

Drilling and grouting were completed on November 5, 1985. Seeding, fertilizing, mulching, and all other items were finished on November 7, 1985.

Locations of all boreholes in the project area are shown on the enclosed Drawing No. 1.

QUANTITY SUMMARY:

The following is a summary of the primary reclamation items for this project.

Drilling Exploratory Borehole	43 Each
Case Exploratory Borehole	2 Each
Drill Grout Injection Borehole	9 Each
Redrill Existing Borehole	4 Each
Grout Injection	624 C.Y.
Fertilizing, Seeding, Mulching	0.75 Acre
TOTAL Construction Costs	$102,906.46
Mine Area Reclaimed	0.55 Acre
Cost Per Acre Reclaimed	$187,102.65

A significant underrun occurred in the grout injection quantity. The underrun was due to the actual mine layout. Only one narrow haulageway

actually crossed the highway and the pillars under the highway were wider than anticipated. The Contractor and his subs were satisfied with the project with the underrun and no cost adjustment was necessary.

COMMENTS:

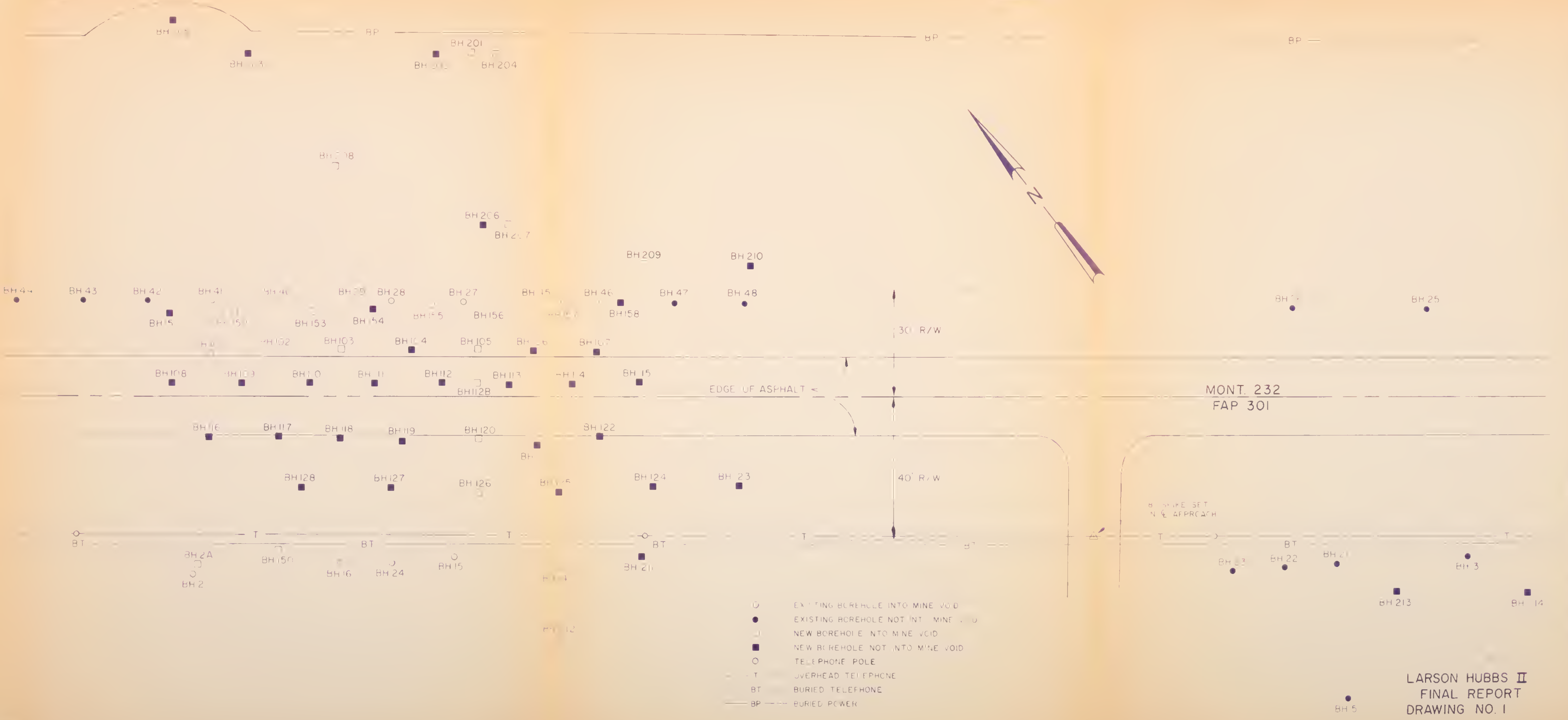
The grouting technique appeared to work well. The grout coverage from a single hole was greater than anticipated. Pressure grouting appears to work well in conditions of significant roof collapse and with the presence of groundwater.

The Contractor was easy to work with and he was willing to try different techniques as the conditions warranted. The Contractor demonstrated his ability to perform quality work in conformance with Specifications.

The completed project was approved by the Department of State Lands, the Landower, and L.C. Hanson Company.

LARSON HUBBS II SLIDE LOG

2.	October 22, 1985	Driller installing casing in BH-24.
3.	October 23, 1985	Cones set out for single lane closure. Drill setting up on BH-101 on edge of pavement.
4.	October 24, 1985	Grout injection pipe set in BH-101. Also shows crane used for handling injection tubes and the concrete pump truck used to pump grout.
5.	October 24, 1985	Injection pipes set in both BH-101 (between workmen) and BH-152 (in front of crane).
15.	October 31, 1985	Drilling BH-126 in west ditch.
16.	October 31, 1985	Inserting injection tube into BH-120. Note water line connected to hoisting plug. Water circulated during insertion of pipe due to hole caving.
17.	October 31, 1985	Same as Photo 16. Working pipe up and down to clear caved material.
18.	October 31, 1985	Grouting equipment set up on BH-126 prior to grouting.
19.	October 31, 1985	Injecting grout into BH-126.
20.	October 31, 1985	Injecting grout into BH-150. Shows grout truck, grout pump, and injection line and tube.
21.	November 7, 1985	Haul road used by concrete trucks after duckfooting, fertilizing, seeding, and mulching.
22.	November 7, 1985	Photo 1 of 3. Looking north across highway. Photo shows condition of field east of highway after restoration and duckfooting.
23.	November 7, 1985	Photo 2 of 3. Looking northeast across highway.
24.	November 7, 1985	Photo 3 of 3. Looking east across highway.
25.	November 7, 1985	Hand spreading mulch on seeded area west of highway.
26.	November 7, 1985	Mulch spread on seeded areas west of highway.



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DRAWING NO. 1

L. C. Hanson Co.
CONSULTING CIVIL SANITARY MUNICIPAL
HELENA, MONTANA

LARSON HUBBS II
BOREHOLE LAYOUT

DDR

JAN, 86

1" = 20'

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